What is claimed is:

1. A polymethylaluminoxane preparation generated by thermal decomposition of an alkylaluminum compound having an aluminum-oxygen-carbon bond, the alkylaluminum compound being generated by a reaction between trimethylaluminum and an oxygen-containing organic compound, wherein:

(i) the oxygen-containing organic compound reacting with trimethylaluminum is an aliphatic or aromatic carboxylic acid represented by the general formula (I),

$$R^1-(COOH)_n \quad (I)$$

(wherein R^1 represents a hydrocarbon group of C1-C20 straight or branched alkyl groups, alkenyl groups or aryl groups, and n represents an integer of 1 to 5);

(ii) a mole fraction of methyl groups originating from aluminoxane part, relative to the total moles of methyl groups existing in the generated polymethylaluminoxane preparation is not more than 26 mol%; and

(iii) the generated polymethylaluminoxane preparation has a viscosity of not more than 2.1×10^{-3} Pa•sec at 40°C.

2. The polymethylaluminoxane preparation according to claim 1, wherein

the oxygen-containing organic compound represented by the general formula (I) is benzoic acid.

3. The polymethylaluminoxane preparation according to claim 1, wherein

the oxygen-containing organic compound represented by the general formula (I) is toluic acid.

4. A method of producing a polymethylaluminoxane preparation having a mole fraction of methyl groups originating from aluminoxane part, relative to the total moles of methyl groups of not more than 26 mol% and a viscosity of not more than 2.1×10^{-3} Pa•sec at 40°C, the method comprising the steps of:

causing trimethylaluminum to react with an oxygen-containing organic compound represented by the general formula (I),

$R^1-(COOH)_n$ (I)

(wherein R^1 represents a hydrocarbon group of C1-C20 straight or branched alkyl groups, alkenyl groups or aryl groups, and n represents an integer of 1 to 5) to form an alkylaluminum compound having an aluminum-oxygen-carbon bond; and

thermally decomposing the alkylaluminum compound,

wherein a ratio between a mole number of trimethylaluminum and a mole number of oxygen in the oxygen-containing compound represented by the general formula (I) is in the range of 1.25 to 1.40 : 1.

5. The method of producing a polymethylaluminoxane preparation according to claim 4, wherein

the thermal decomposition is conducted in the absence of a Lewis acid compound in production of the

polymethylaluminoxane preparation.

6. The method of producing a polymethylaluminoxane preparation according to claim 4 or 5, wherein

the oxygen-containing organic compound represented by the general formula (I) is benzoic acid.

7. The method of producing a polymethylaluminoxane preparation according to claim 4 or 5, wherein the oxygen-containing organic compound represented by the general formula (I) is toluic acid.

8. A polymerization catalyst for olefins, comprising as catalytic components:

a transition metal compound represented by the general formula (II),

$$MR^5R^6R^7R^8 \quad (II)$$

(wherein M represents a transition metal element, and R^5, R^6, R^7, and R^8 represent organic groups that form together a cycloalkadienyl backbone, such as an alkyl group, an alkoxy group, an aryloxy group, an alkylsilyl group, an alkylamide group, an alkylimide group, an alkylamino group, an alkylimino group, or a halogen atom); and

the polymethylaluminoxane preparation according to any one of claims 1 to 3.

9. A method of polymerizing olefins using the polymerization catalyst according to claim 8.